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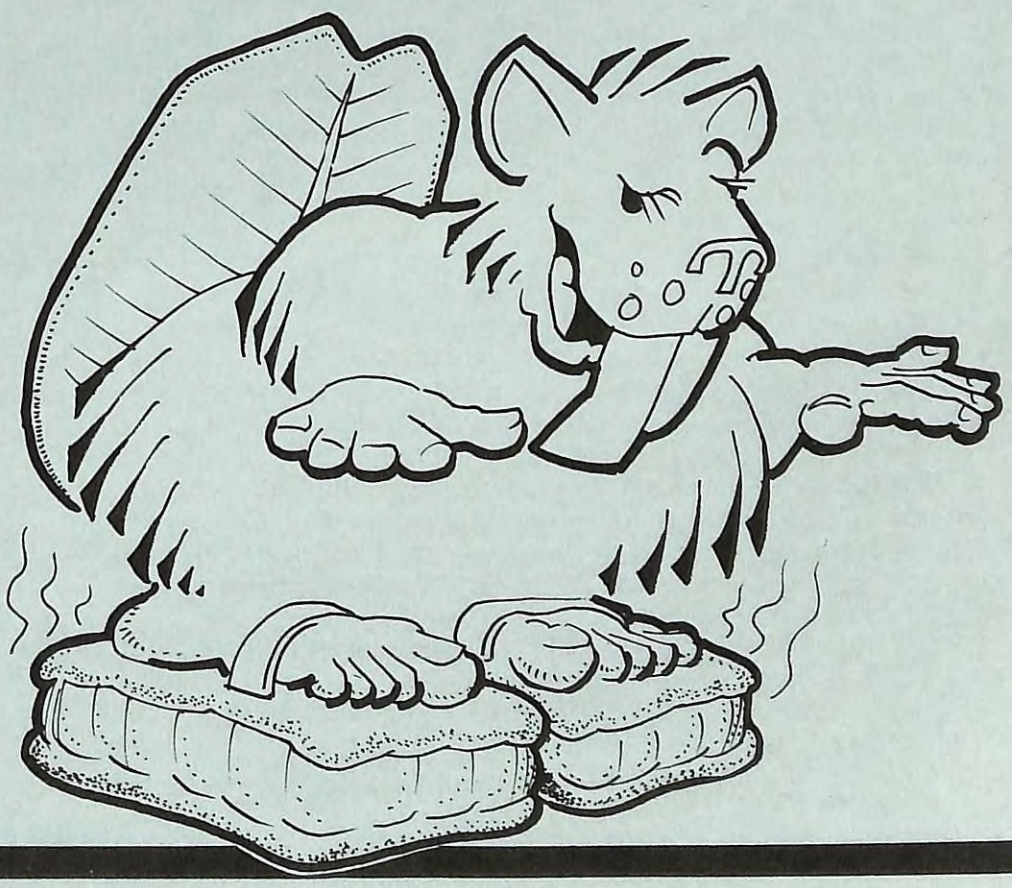
Frost Protected Foundations



From the editor . . .

It seems that one can't do too much today without running into rules and regulations. Some we impose voluntarily on ourselves, such as club and society bylaws, some like condominium rules and regulations we accept, and others are imposed on us for the common good, such as laws to maintain order and good government. Other regulations are applied to our work activity, such zoning bylaws and building codes.

The issue is how far should regulations go? Building codes are getting so complex that specialist training is needed just to be able to find out anything that's contained in the code. Even the people that have to administer them are having a hard time understanding the rules! Are things getting out of hand?

I am a firm believer that we need to have some regulations. Often many have been a major progressive force. It's regulations that have eliminated child labour (at least in our country), provided mandatory education, made automobiles safer, and improved the quality of our housing.

Like it or not, we tend not to change the way we do things unless something pushes us. The push can be customer demand, regulation, or some combination of the two. The question being debated is how to encourage change without the shotgun. Discussion is being driven by what's happened with the National Building Code change process this year, where more than 1200 changes were proposed. In B.C., regulatory reform discussion has been opened up by a government paper about the purpose and role or building regulations. Some fear it will simply add more rules and regulations, going far beyond the traditional structural health & safety issues, using regulations to drive social change.

It's very easy to draw up new regulations. It's very easy to criticize them.

But are there other ways of ensuring good quality housing without prescribing everything? How do you get the marketplace to make changes when they don't know what the options are? How can the homeowner ask for a more efficient furnace, high performance windows, or whatever if the manufacturer either doesn't try to promote the product, or maybe isn't even making it? What about when industry drags its heels on innovation and change, stalling upgrading by using pricing mechanisms to discourage upgrades? We've also heard that price increases are often hidden at the time that new regulations are introduced, so that a price increase can be blamed on the regulations, even if it is not true.

It happens all the time, although we don't want to admit it. Canadian manufacturers have not always been in the mainstream of innovation - it is usually small players who don't have the muscle to help drive a market.

Yes, some of the changes may cost money, and we must be careful that affordability is not affected. Even if some of the proposed regulations have a payback, they are not always noticed by consumers, so that they can't ask for the new features, even if they might to their advantage. Even financial organizations don't pay enough attention to operating costs, rather than just the first cost.

I haven't heard too much discussion about alternative ways of encouraging the marketplace to adopt reform, other than the easy out of new regulations. Perhaps it's time to investigate creative alternatives to regulations, rather than just whining.

Richard Kadulski
Editor

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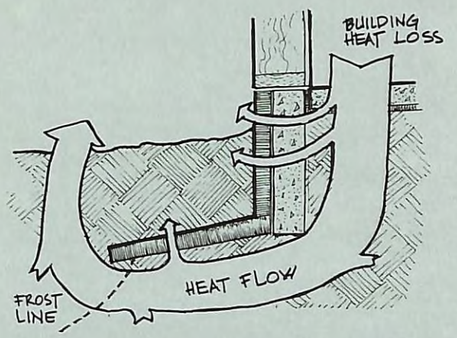
Frost-Protected Shallow Foundations

Why do we keep building deep basements and foundations? Is it out of habit? Do people really expect to have a basement to use, or is it that they've always been a part of our houses (or seem to have been)? They do give a lot of convenient storage space, but is that much storage space really needed if the design could accomodate it elsewhere?

Foundations usually mean significant costs and lots of troubles with waterproofing, settlement, finishing and services. We usually dig full basements to get below the frost line, but how come all those warehouses, shopping centres, etc. are not built with basements? They're usually slab-on-grade buildings.

If housing affordability is an important consideration, we should be giving slab-on-grade foundations more attention. The National Association of Home Builders in the USA, in their search for ways to increase affordability, has singled out slab-on-grade floors as one of the most promising cost-saving opportunities.



Frost-protected shallow foundations for slab-on-grade construction are a practical alternative in regions where more costly deep foundation construction methods are used. Foundations as shallow as 16 inches can be built in the most severe climates as long as they are built carefully.

It has been known for some time that the heat from buildings raises the frost depth at the perimeter of the foundation. In other words, the frost line rises near any foundation if the building is heated and/or insulated. A frost-protected shallow foundation (FPSF) relies on strategically placed insulation to raise the frost depth around the building by regulating the heat loss.

If frost doesn't get at the foundation, or the soil next to it, then there can't be any damage. Frost heaving happens only when soil temperature falls below freezing and there is enough moisture in the soil so that the expansion of freezing water cannot be accommodated within the space between soil particles. Most frost prevention measures either remove water from the soil or locate footings below the depth of natural frost penetration. Insulation materials offer another approach - thermal control.

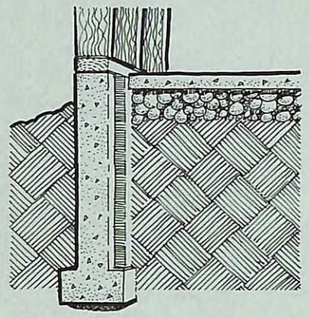
Preserved wood foundations are built on a drain rock layer at least 6" deep under the entire foundation. This is used to provide site drainage and as a means of lowering the water table. The same approach can be put to use under a slab-on-grade to remove water and the potential of frost damage. The same principle is used on many highways, railways, and airport runways, where frost susceptible soil is insulated to reduce frost penetration.

Insulation around the foundation perimeter conserves and redirects heat loss through the building slab toward the soil beneath the building. At the same time, geothermal heat resources are directed toward the foundation resulting in a shallower frost depth around the building. The use of slab-on-grade construction simplifies the layout and construction of foundations and can reduce site preparation and foundation construction time by nearly four days.

Most of the recent refinements in the understanding and application of shallow foundations have come from Scandinavia where they are standard practice. Between 70 and 90% of all houses built in Scandinavia - over 1,000,000 units - have been built on shallow foundations in the last 35 years.

In the post-war housing boom of the late 1940's and early 1950's, production builders like William Levitt (Levittown) met the market volume and demand for inexpensive single family houses in part by eliminating basements. Slab floors were not widely used for houses in northern regions before World War II.

The Norwegians first experimented with shallow foundations in the 1950's and in 1969 the first major housing subdivision to use frost-protected design broke ground near Oslo. The Swedish building code approved frost-protected slabs with foundations extending only 14 inches below grade in 1967 and the practice is now commonplace throughout Sweden, Finland, and Norway.



Conventional frost protected foundation: foundation wall to below frost line, and insulation placed on he interior.

Canadian Researchers Eli Robinsky and Keith Bespflug at the National Research Council published a design method in 1973 that is often used for warehouses and industrial buildings. (Key design information is reprinted in DOW's sales literature).

The NAHB Research Centre monitored the construction and performance of three demonstration houses using FPSF's, in North Dakota, Iowa and Vermont. Each represented a variety of geographic and climatic conditions. The FPSF offered cost savings that ranged from 1.1% of the home's sales price in North Dakota, to 3.8% in Iowa.

Where to insulate the slab?

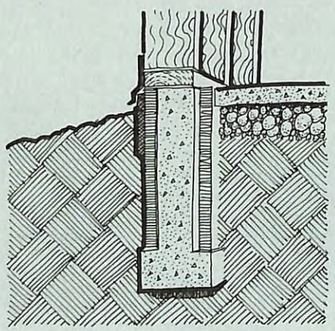
The slab edge accounts for a large part of the perimeter heat loss of concrete slabs. Insulation installed under the slab or at the inside face of the frost wall is not very effective if the exterior slab edge is not insulated.

Concrete slab details that appear in standard handbooks are really meant for southern regions and do not deal with the cold climate problem of accommodating two or more inches of insulation at either inside or outside of the frost wall. While it is easy to lay thick insulations under the slab or to stand it up at the inside face of the frost wall, extending this thickness through the slab edge joint is more thermally efficient. Overhanging 2 x 6 studs beyond the exterior face of the frost wall or over the edge can solve some of the problems.

Exterior insulation is easily damaged during construction, and requires special finishing details so for this reason many builders and designers insulate only the below-grade section of the wall, preferring to expose the structural concrete or masonry. However, because most of the heat escapes above grade, this is not a good detail; it is much better to move the insulation to the inside surface of the wall if an exposed structure is desired.

. . . uninsulated slab edge joint reduces energy saving by 40% . .

The most recent and thoroughly studied set of recommendations shows that a one- or two-inch thickness of rigid foam in a four-foot width, regardless of orientation, is cost-optimal over a 30-year life cycle throughout the northern U.S. Interior installations are almost always more cost-effective than exterior installations, provided there is a thermal break at the slab edge.



Foundation insulation can be placed on the exterior of the foundation wall, inside, or a combination of both. At grade, exterior insulation needs to be protected. For ease of finishing, 2x6 framing can extend past the face of the concrete.

Computer simulations on which the U.S. Dept. of Energy recommendations are based assume an R-5 thermal break between the slab edge and frost wall for all under-slab and interior wall installations. The same simulations show that an uninsulated slab edge joint reduces energy saving by 40% under many normal conditions.

It is a good idea to increase the thickness of the insulation by 50% in the vicinity of the corners, for a distance from the corner equal to the width of the skirt. Elevating the slab above exterior grade level deprives the footing of some heat from the slab. This could be compensated for by increasing the thickness of the insulation on the stem wall.

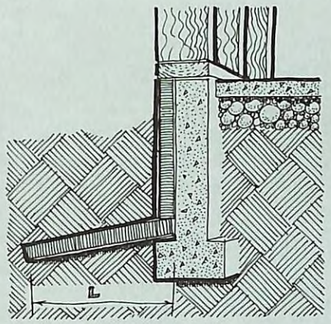
Insulation is as important to cooling performance as it is to heating performance, and installation detailing is important to balance the heating and cooling season benefits.

One construction detail for slabs commonly used by some builders is to place a 2" sand bed on top of the vapour retarder and insulation. The sand bed is placed there to allow excess water to drain from the bottom of the wet concrete and by preventing puddling within the setting slab, improves curing conditions. This is supposed to reduce shrinkage cracking and curling of the slab edges. The sand bed also protects the vapour retarder from damage during the concrete pour.

However, a sand layer is not strictly required. A low slump mix may reduce shrinkage cracking within acceptable limits when poured directly on the vapour retarder; and care in layout and striking of control joints can satisfactorily accommodate shrinkage.

Slab-on-grade construction is very common in British Columbia. What about the colder locations? Don Roscoe in Halifax, N.S. has been building slab on grade passive solar homes throughout Nova Scotia for a number of years quite successfully.

A 26-unit senior citizens' apartment building in Pefferlaw, Ontario (about 56 miles northeast of Toronto) was built on a frost protected shallow foundation. The estimated frost depth in the area is 4 feet.The spread footings were insulated with a 3 inch thick (R-15), 4 ft wide skirt of extruded polystyrene. The insulation was installed horizontally, covered with a polyethylene sheet, ¼ inch fibreglass protection board, and about 11 inches of earth. The full thickness of insulation was applied to the stem wall to a height of 6 inches above grade.



Frost protected shallow foundation: insulation is extended horizontally (or at a slight outward angle) from the shallow foundation. For most locatons L = 4 ft. , R-5 min.

The monthly average January temperature (1987 and 1988) was about -8°C. Soil temperature measures around the footings, both above and below the insulation showed that the soil temperature was as low as - 12°C above the insulation, and remained frozen most of the winter, but the soil temperatures at the outside bottom of the footings never dropped below +5 - 6°C.

How much insulation is needed?

In their brochure on insulation for Geothermal Applications Dow Chemical has published graphs that can be used to establish minimum insulation requirements for FPSF.

For heated buildings on clay or silty soil the minimum insulation level is R 5 extended 4 feet out from the building.

On sandy soil the insulation level has to be increased. If the insulation skirt is extended out 4 feet, a minimum insulation level of R 7.5 is needed for areas with a freezing index up to 3,000 °F degree days.

With an insulated floor slabs (as is required for radiant heated floor slabs), the perimeter insulation will have to be increased, as the heat loss from the house will be reduced.

Freezing Index is the total number of degree days of freezing for a given winter.

The freezing index for Canadian locations varies widely. A random selection of Canadian locations is listed in the table.

City	Freezing Index	
	°F Degree Days	°C Degree Days
Victoria, B.C.	28	16
Vancouver	31	16
Kamloops	603	335
Prince George	1,670	928
Whitehorse	3,574	1,986
Edmonton	2,593	1,441
Calgary	1,791	995
Saskatoon	3,284	1,824
Regina	3,175	1,764
Winnipeg	3,251	1,806
Yellowknife	6,506	3,614
Toronto	629	349
Ottawa	1,829	1,016
Thunder Bay	2,541	1,412
Windsor	565	314
Montreal	1,583	879
Quebec	2,059	1,144
Chicoutimi	2,536	1,409
Fredericton, NB	1,561	867
Charlottetown, PEI	1,201	667
Hallifax, NS	856	476
St. John's, NF	648	360
Corner Brook, NF	1,120	622
Goose Bay, NF	3,268	1,816

Foundation Frost Damage

Survivors of the winter of '93 will remember the cold of this past winter - it exceeded standard design conditions.

The importance of frost protection is not restricted to slabs-on-grade. Now that the frost is coming out of the ground, we are seeing evidence how deep the frost went, as there are a lot of foundation problems.

Frost penetrated into many foundations, leading to structural damage. New homes in Ontario that meet recent code changes requiring a drainage layer on the exterior of the foundation have not suffered the frost damage. It seems that the drainage layer acts to provide a slip plane, so that any ground heave action is cushioned. But as the drainage layer is only needed for the basement and not an attached garage, problems in the garage portion of the house are making a bad situation worse.

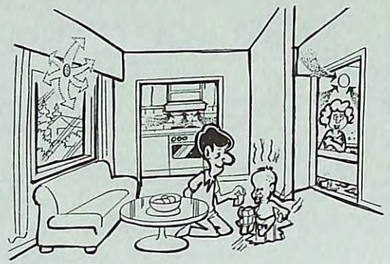
It is ironic that the newer, better insulated foundations (if insulated from the inside) may be more vulnerable to frost problems as the insulation keeps the heat in, which is what we want to do to maintain comfort and reduce energy use, unless good drainage is provided to keep the soil dry. The heat that escaped from uninsulated houses was keeping the ground warmer, so that frost penetration was not as deep, and frost problems in many situations were avoided.

Residential Ventilation

We've learned that we must provide ventilation into our homes, but we're still learning how to do it properly. Ventilation of homes is misunderstood by many in the industry, including many regulators. We thought it appropriate to review where we're at today.

Unfortunately, there are three types of ventilation (see p.7), each with its own meaning, each very important. The biggest area of concern is with ventilation for people, as the other two (ventilation of building components and ventilation for combustion appliances) are reasonably well understood.

Why ventilate?



Today's homes are being built better and more airtight than in the past, when uncontrolled air leakage (and drafts) took care of a lot, but not all, of the air change that was needed to provide fresh air. Ventilation is needed to control indoor air quality, excessive humidities, and odours, all a result of occupant activities. The need to ventilate for people, to control the indoor air quality is now understood, but how to achieve it effectively is still debated.

Fresh air in older houses was provided, in part, as a result of the presence of fuel burning appliances. Most flue designs require such large volumes of air to generate and maintain a draft that substantial volumes of house air are moved out of the house, thus pulling in outdoor air as a replacement. Whether we wanted or not, our houses were well vented by accident during the heating season, although from an energy efficiency and comfort point of view it was not very efficient..

How significant that air exchange can be is evident in houses with no combustion appliances, such as electrically heated homes. These often have problems of excessive humidity and poor indoor quality.

Even the best ventilation system will not be effective if it is expected to take care of sources of pollution built into the house. Firstly, there is no certainty about how big the pollutant load is, as it depends on the specific materials, and some pollutants are generated continuously, over the service life of the material. For example, the emissions of urea-formaldehyde from particleboard materials continues all the time. The warmer and more humid the conditions, the more emissions you'll have.

Likewise, it won't be able to cope with abuse of the indoor environment by the occupants. That is not what ventilation should be trying to do. If you do try and take care of this the you may be over ventilating the house, leading to extremely dry conditions inside the house in winter.

Home owner instruction

Just as we've had to learn about ventilation, and what effective ventilation systems are, so home owners must be instructed how to operate their home and mechanical systems. The lack of information is the biggest single problem we see. However, we are also seeing that once people get to appreciate an effective system in their home environment, they will maintain it, otherwise, when the system stops working they quickly sense something is wrong.

How much ventilation is needed?

There is still a lot of debate on this issue, even through standards have been drafted and are being implemented. We have learned that a little goes a long way. There appears to be agreement that for adequate fresh air for metabolic processes we need about 10-15 cubic feet per minute (5-7 litres/second) per person.

A house contains a large quantity of air. That is why even if you have uncertain air change rates, as in older houses, people will get enough air, although it may not be as high a quality as it could be. We have learned that there is a fine balance that must be achieved to provide a comfortable environment. If you overventilate the house, especially in winter, it will be too dry indoors. If you ventilate at too low a rate, you get a build-up of indoor pollutants.

A properly functioning ventilation system should run continuously, rather than intermittently. A bathroom fan, run for 30 minutes in a day, will only move about 750 cubic feet of air, while a person in the house for 12 hours per day needs about 10,800 cubic feet. (a typical 1400 sq.ft. bungalow on basement contain around 24,000 cubic feet of air).

Our mechanical ventilation standards have been based on standards developed in Scandinavia where 0.5 air changes per hour is required for residential ventilation systems. A ventilation system standard that is based on the volume of the house, rather than the occupancy requires that there be a consistent house size.

Scandinavian research is second to none, but it must be realized that their housing stock is fairly uniform in size, and much smaller than Canadian houses. The Swedish home is typically 1,000 - 1,400 sq.ft. without basement (or around 9,000-12,000 cubic feet of air). Our houses are much larger (that basement adds a lot of floor area and volume that has to be considered!). What about the extra volume of air contained in a vaulted ceiling? or in a 9 foot high ceiling room that is so common today?

A better way to spell out required ventilation rates is to base it on occupancy only, which can be established based on number of bedrooms. The CSA Residential Ventilation Standard (F326) is moving in this direction, but there is still a requirement for system capacity based on the volume of the house, rather than just occupant loading. Ventilation rates just based on volume of the house will overventilate houses, especially those that have large rooms and contain vaulted spaces.

There is a nagging doubt that the ventilation standards have been written to take into account possible pollutant loading that may be built into the house (finishing materials, furniture, etc). Unfortunately, this creates unwarranted penalties for the home owner, the builder and designer, who are faced with having to try and accommodate conditions that are strictly beyond their control.

A builder often doesn't know who the home owner will be, and what kind of lifestyle they will lead. Standards are normally laid out to cover most average situations. But should regulations anticipate unconventional lifestyles and activities? Should systems be designed and laid out so that, just in case, when someone with a hobby that involves a lot of toxic materials moves in, the air quality will still be satisfactory? Who should be responsible - the builder or the home owner? Just how far can regulations go?

Ventilation Effectiveness

Not only must there be a proper quantity of ventilation, but equally important is how effective the ventilation system is. The fresh air should be distributed to those areas where it will do the most good, and stale air exhausted as close as possible from the sources of pollution - usually the bathrooms and kitchen.

Do you really want those bathroom aromas, or the garlic fumes from the kitchen, to float around the house before being exhausted? It may seem far fetched, but that is exactly what is acceptable in Ontario where the building code allows a simplified HRV system to take exhaust air from the return air plenum, and supply fresh air directly to the return air plenum, downstream of the exhaust. It's difficult to see how effective this approach can be to removing odours and moisture from bathrooms and the kitchen if the pollutants have to find their way into the return air plenum first. Studies have found that

The Three Faces of Ventilation

1. Ventilation of building components

Of concern to builders for the long term durability of construction. Ventilation of construction means venting of the structure outside the heated envelope of the building: roof cavities, wall assemblies, crawl spaces, etc.

2. Ventilation for people

This is the provision of clean fresh air inside a building to maintain a safe and healthy indoor air quality. It removes pollutants generated inside the building by human occupancy (exhalation, perspiration, etc), occupancy related activities (cooking, washing, plants, pets, etc), and interior finishes and furnishings.

Obviously, we should think twice about introducing finishes and materials inside that are a source of pollution, as the best ventilation system may not be able to deal with materials emissions; besides, it's difficult to size a system for something you don't know about. People generated pollutants are easier to deal with, as we know to a fair degree how many people will live in a home, and how much pollutant load is generated per person.

3. Ventilation for combustion

If you burn something, pollutants are generated. If you burn coal, oil, or wood, the combustion process is so easily corrupted that you can actually see and smell the by-products if they end up where you don't want them. That is why we've learned a long time ago that to control the pollutants you need flues to channel the fumes. This can be thought of as ventilation for combustion appliances.

Natural gas burns much cleaner, but there are still pollutants generated that have to be removed. Unfortunately, we've heard that somebody still does not want to acknowledge this and is promoting a "flueless" gas heater/fireplace. In the past we've tried to highlight the insanity of current regulations that allow an unvented gas range, but require fully vented fireplaces (even though they may only consume half the gas). Now comes along a product that (we understand) has been certified with no venting.

typical forced warm air heating system return plenums are not as effective as everyone seems to think.

System Types

Ventilation systems can be categorized into four basic systems.

Distributed exhaust only systems

This is the simplest ventilation system. Exhaust fans expel air from the house while outside air is drawn into the house through the cracks and openings of the building envelope. Essentially it means one or more bathroom fans, plus kitchen range hood. At least one of the fans should be a quiet, better quality fan controlled by a dehumidistat. Make-up air, to avoid backdrafting of combustion appliances, may be needed if the exhaust fans are capable of creating large negative pressures in the house.

The disadvantage to this type of system is that there is no control on the location and quantity of the fresh air supply, and the fans are usually very noisy so they are only run for short periods, rather than continuously.

Central exhaust system

Rather than a series of fans, a single better quality fan that can be remotely located, is used to exhaust stale air. It may be operated for longer time periods with less noise or discomfort. It does require ductwork from the rooms that are being exhausted.

However, like the distributed exhaust system, there is little control on the fresh air supply and it's distribution. If there is a forced warm air heating system the fresh air can be ducted directly into the return air of the furnace, so that fresh air can be circulated by the furnace.

An approach used in Europe to provide fresh air is to have supply air vents into each room that is not being exhausted. The central exhaust fan puts the house under a slight negative pressure, and specially designed inlets allow small controlled quantities of fresh air into the room (these are often located over the window). This type of system requires the house to be quite airtight, and in extremely cold climates (temperatures below -20°C) it could create uncomfortable drafts.

To avoid backdrafting of combustion appliances make-up air may be needed if the fans are capable of creating large negative pressures in the house.

Balanced ventilation system

This is a system that has two fans: one exhausting, one supplying fresh air in equal amounts. A central fan unit is used to provide the balanced flows, and the supply and exhaust flows are ducted throughout the house. Typically, this is a standard heat recovery ventilator (HRV) system.

Ventilation and heating systems

The kind of heating system to be used in the house is an important consideration as the ventilation system can be connected to some kinds of heating systems. Equally important is the number and type of combustion appliances in the house, as exhaust only systems, by placing the house under negative pressures, will affect the operation of flues.

Indoor Air Quality in Sweden

Perhaps because they are far away there is a tendency to believe that the indoor air quality of housing in Sweden is superior. Maybe they just have better PR, but there is no doubt that Swedish housing stock is good quality - but it's not perfect.

We came across a report about a major nationwide study of the indoor climate in Swedish housing. It provides some interesting insights. Twenty thousand residents in about 3300 single-family houses and multi-family buildings were surveyed. It was found that 1 out of 10 Swedes lives in unhealthy dwellings.

The resident survey of their experiences of and feelings about their indoor environment was followed up with site inspections and indoor air measurements of the ventilation rates, indoor temperatures, interior relative humidity, formaldehyde and volatile organic compounds (VOC's) and radon levels in each dwelling.

The general conclusions are that ventilation in Swedish dwellings does not come up to the norm (0.5 air changes per hour) in four out of five single-family houses and in half the apartments. Ventilation is poorest in dwellings with natural-draft ventilation. Radon levels are higher than the limit for existing buildings in 90,000 - 200,000 dwellings but formaldehyde levels are low.

The most common complaint about indoor air is that it is too dry. The Swedish ventilation standard of 0.5 air changes per hour (often referenced in Canada) is suitable to Swedish housing stock, which is fairly uniform in size (typically 1100 - 1400 sq. ft. for a 3 bedroom house, no basement). By contrast, Canadian housing stock varies in size across the country and houses of 2,500 - 3,500 sq. ft. plus basement occupied by a family of 2 or 3 are not at all uncommon.

Those who suffer most from problems with the indoor climate are persons suffering from allergies. They show a frequency of eye, nose and throat symptoms three to four times higher than those of other people. Other troubled groups are residents in new, large multifamily buildings, who have the highest frequencies of complaints. Most are about dry air, drafts, stuffy "bad" air, noise, dust and dirt. Women are troubled more than men.

The study results are published as ***The Indoor Climate in the Swedish Housing Stock*** *(available in English) by the Swedish Council for Building Research.*

Letters to the Editor

Re: New R-2000 indoor air quality Requirements

(Solplan Review No. 55, Feb-Mar '94)

Sir,

Like many in the housing industry, I'm pleased to see the R-2000 Program placing increased emphases on the indoor environment, and especially happy to see that most of the indoor air quality requirements focus on pollutant source control. A closer examination of the requirements, however, suggests that the impact may be considerably less than expected.

R-2000 builders are only required to meet the requirements for two of six product categories: carpeting, medium efficiency filters, paints and varnishes, flooring adhesives, cabinets and wood floor finishes.

Let's start with the requirements for carpeting, which is associated with a number of volatile organic compound (VOC) emissions. The R-2000 options include some low-emission alternatives, such as wool or cotton area rugs, or non-glued carpets with latex-free backings. However, another allowable option is to use standard carpeting, limiting its use to 50% of the total floor area. In a typical new house, the builder normally does not install carpeting in the basement, kitchen, breakfast area, bathrooms, entry, mudroom or under partition walls. This means that carpeting is normally limited to 40 - 45% of the total floor area in a bungalow and 50 - 55% in a two-storey. In other words, all bungalows automatically meet the R-2000 requirements, and 2-storey homes need only some fine tuning of the area calculations to qualify.

Next, let's look at the requirements for kitchen and bathroom cabinets, which are associated with formaldehyde emissions from composite boards. Again, the options include some low-emission alternatives, such as formaldehyde-free fibreboard, solid wood, or particleboard with all surfaces and edges sealed. However, another R-2000 option is to use particleboard which meets the U.S. HUD standard. This standard specifies a maximum concentration of formaldehyde of 0.3 ppm in a test chamber, under loading conditions which approximate a room particleboard decking or underlayment, at a ventilation rate of 0.5 air changes per hour and at specified temperature and humidity conditions. All 12 Canadian manufacturers of particleboard submit their products to Forintek for regular testing to this standard, as part of the Canadian Particleboard Association's certification program. According to Forintek, no product has ever failed the test. In other words, all Canadian particleboard available for residential uses meets this R-2000 standard.

(However, use of the HUD Standard prevents the use of non-conforming U.S. particleboard which may be dumped into Canada).

So by following conventional practice for carpeting and particleboard, not only does virtually every R-2000 house meet the new IAQ requirements, but so does virtually every non-R-2000 house.

My intent in raising these issues is not to criticize the R-2000 Program. The Program deserves praise for taking a posi-

Re: Baseclad: use it or lose it

(Solplan Review No. 55., Feb-Mar '94)

Sir,

I am concerned that some readers may misinterpret information within the first two paragraphs to mean that *Baseclad and/or Drainclad* do not require a waterproofing or damp proofing step prior to their application on exterior foundation walls; i.e. *Baseclad/Drainclad* "waterproofs and insulates foundations at the same time". This potential for confusion became clear to me when discussing whether damp proofing was a necessary step with Nanaimo Building Inspectors. The CCMC product report (CCMC 09860-L) confirms that Fiberglas *Baseclad/Drainclad* should be applied "after normal damp proofing".

I also thought this would be an opportunity to bring to your attention *Styrofoam* Perimate** Insulation & Drainage Layer. This grooved Type 1V, extruded polystyrene was developed in Ontario to help builders meet insulation and drainage requirements as outlined in the 1993 Ontario Building Code.

In addition to providing an effective drainage layer, *Styrofoam* Perimate** gives a long-term thermal resistance of R5/inch. Like *Drainclad/Baseclad, Styrofoam* Perimate** requires a damp proofing layer prior to installation. Unlike *Drainclad/Baseclad, Perimate** is not limited to use in areas of low lateral pressures, i.e. sandy soils.

Wendy Rae
Pacific District Sales Office
Dow Canada
Richmond, B.C.

Thank you for bringing the CCMC requirement to our attention. However, damp proofing is not a water proofing - it merely acts as a capillary break to water on the surface of the concrete. When a product such as Baseclad (or any other similar drainage material), is carefully applied, from a building science point of view, there should not be any need for the damp proofing.

The common practice of applying the damp proofing is a "belt and suspenders" approach that anticipates sloppy workmanship and problems on a site.

I've found Baseclad easy to use and have used it for earth sheltered homes - with not added waterproofing applied. Ed.

tive step in the direction of source control. CHBA has stated that these requirements were not intended to be onerous, but rather to get builders to start thinking about indoor air quality. I support this approach. However, if the Program wishes to use the new indoor air quality standards to distinguish R-2000 homes from typical homes with respect to indoor pollutant emissions, then these standards should require some degree of change from conventional construction practice. This means re-examining the requirements for carpeting and cabinets.

Terry Robinson
Scanada Consultants Ltd
Ottawa, ON

Sir,

I thought that it might be useful to your readers if I clarified some technical aspects of the

R-2000 indoor air quality requirements related to carpeting and kitchen cabinets. These issues were dealt with by the CHBA Technical Research Committee's Research & Development Subcommittee, and subsequently adopted by NRCan for use in the R-2000 program.

Carpeting:

The 50% interior floor area requirement was chosen so that in most homes at least the basement would not be carpeted. Although in tract built and manufactured homes the basement is not usually finished, in custom homes finishing is more frequently done. Not having carpeting in the basement should lessen source indoor air quallity problems such as mould growth - worth noting for builders and homeowners alike. Expanding the requirement (in large measure) to the upper floors creates problems with finding an affordable flooring alternative to carpets. The Committee did not believe that the R-2000 Program should turn into a "Hardwood Flooring Program".

Testing in the U.S. has shown that carpeting that carries the Carpet and Rug Institute's (CRI) Green Label (an industry IAQ testing/labelling program) may sell present IAQ problems. This has forced the carpeting industry to re-examine this labelling effort. Consequently the Green Label was not endorsed by the Committee at this time.

Kitchen Cabinets:

One way to meet this requirement is to use particleboard meeting the HUD emission standard. Most particleboard manufactured in Canada meets the HUD standard. But since there is no legal (i.e. building code) requirement anywhere in Canada for particleboard to meet the HUD standard, imported board may not meet this regulation. The R-2000 requirement is attempting to ensure that all particleboard at least meets the HUD standard. The next move may well be to require particleboard meeting a higher emission standard such as the E-1 European standard or an equivalent.

I hope that his information will help to clarify some of the reasoning behind R-2000's indoor air quality requirements. CHBA is committed to working with NRCan and the many program partners across Canada to keep R-2000 at the leading edge of production housing. We value constructive comments which will help R-2000 maintain its leadership position in the marketplace.

John Broniek, P. Eng
R-2000 Technical Co-ordinator
Ottawa, ON

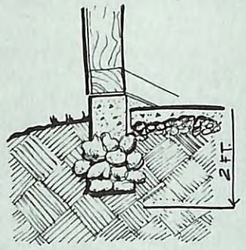
The Great Canadian Reno-Demo Project

After many years in an apartment, your editor purchased a 90 year old North Vancouver house - a real oldie in this part of the country. Now comes the fun of renovating this house.

In the last issue of Solplan Review we described the project. We aim to make it a demonstration project to show the benefits of recycling and adapting existing housing stock. The work includes building a secondary suite in the existing basement plus a small addition. The work will incorporate the latest energy efficient construction approaches for new and retrofit construction and will make use of new products and materials that reduce indoor pollutant loading of the dwelling to maintain a more healthy indoor environment.

Phase one is the preparation of the basement, which means lowering the floor by about 2 feet to provide a 7'6" minimum floor/ceiling height. Fortunately, the existing concrete is weak, and only about two inches thick, so that the jack-hammer works at it like a knife in butter.

They sure don't build them this way any more! We've discovered (surprise, surprise!) that the house has no foundations. The standard minimum foundation depth on the West coast is 18" (due to the shallow frost line), but in this house the foundation is not even that deep. The frame walls sit on a concrete curb, less than 12 inches in height (6 inches above grade, 6" below grade) - it was likely put in many years after the house was built. Underneath the curb is a pile of boulders, none larger than about 8-10 inches in diameter.



This has added a new challenge and means that the work is going to progress more slowly than anticipated, as the excavation has to be done the old fashioned way - by hand and new foundation walls have to be put in - in small sections so as not to undermine the house.

We'll keep readers posted on the progress of the project.

The New R-2000 Technical Requirements: A Good idea?

The R-2000 Technical requirements have been substantially changed for the first time in many years. The principal changes are an improvement in the energy efficiency of the house, improved indoor air quality requirements, and increased environmental responsibility.

The changes were introduced because it has become evident that the general standard of construction in Canada has improved over the past decade. When the R-2000 program first started, a good quality house had R 12 insulation in the wall, R 20 in the ceiling, often no basement insulation, and sometimes even single glazed windows. The level of standard construction today is now a lot close to the R-2000 level, especially in terms of higher insulation levels and more efficient mechanical systems. Some of these changes have been driven by changes in building codes in some areas, and the introduction of new energy efficiency standards for mechanical equipment.

The R-2000 program is seen to be a leading edge program, but if everyone is already building to that standard, it can't be very leading edge. We know that there has been considerable evolution in the construction industry - in terms of new materials, products systems, etc. So maybe it is time for changes.

... the R-2000 house is now becoming a "green" home.

What are the principal upgrades?

Improved energy efficiency

Changes are being made to the energy budget, which is at the heart of the program. The energy budget now starts to deal with the total energy consumption of the house, including: heating, domestic hot water, lighting, fan energy, appliances. A key change is an alteration to the formula that calculates the energy budget, that will adjust the budget for the size of the house. This will eliminate the bias in the present formula that makes it easier for the very large houses to meet the energy target, while small houses have a harder time (because of their larger surface area relative to volume of the house). In other words, for very large houses the budget reduction will be larger, while small houses will have an easier time to meet the target.

The energy target has also been structured to take into account energy consumption for cooling. This will be taken into account at some time in the future when an effective and easy to use tool is developed to take these into account.

The main effect is that the energy budget will be about 15% less than the existing. The challenge to builders will be that a 15% reduction in energy consumption will mean that some changes to construction practices may have to be made. Those that have become accustomed to a given level of insulation levels and other building components may now have to review their construction practices, and upgrade them.

Indoor air quality

Indoor air quality is becoming an increasing concern. We now understand that a significant source of pollutants inside a buildings are those generated by the materials themselves. Accordingly, removing the pollutants in the first place will enhance the quality of the indoor air. While there are few readily acknowledged standards for low emission products, and most materials are not labelled, there is enough knowledge available to start identifying the worst culprits. The new standards provide a "pick list" which provide a series of options from which to chose. By themselves these will not guarantee a perfectly clean indoor environment, but they point in the right direction, and their use will enhance the quality of the indoor air.

The challenge for builders will be to start looking at materials that in the past were not paid much attention. Not all products are labelled, so it may be hard to know whether or not a given product is really better or not. No longer will it be enough to pick a product just on the look and price. It will mean that you have to ask question of suppliers that they have not been asked before. More supervision of subtrades will also be necessary, as they may have to change the way they do their work.

Environmental responsibility

Resource efficient materials. We now know that there is a problem with our past attitudes to development. Environmentally appropriate and sustainable approaches have to be encouraged. In the construction sector, this means making better use of the raw materials that we use. Increasingly, we are seeing more and more use of engineered wood products (that make more efficient use of wood fibre) and products with recycled content. To encourage this further, the new R-2000 Technical Standards provide a "pick list" of options to use.

Opportunities

Typically no one likes changes. Many would say thet the construction industry especially has been slow to adopt new products and systems. The R-2000 program itself was a shock to the industry when it was first introduced, and it took time for builders to accept many of the principles. Now there are even more changes! However, it's been recognized that many codes have caught up, or nearly so, with many of the energy conservation features of the R-2000 program. Thus, there is a feeling that R-2000 standards are already a part of the code. We know that it's not quite so, although it may not be far off.

For further information on the R-2000 Program, contact your local program office, or call 1-800-387-2000

The new changes are not merely more of the same from the past, but are moving further ahead of the code. They provide builders with another way to create a product differentiation in the marketplace.

These standards provide a yardstick by which healthier homes can be built. - and there is more interest among the public in this area. More people are becoming aware of the sick building syndrome. This has been identified in the commercial sector, but it can also be a factor in private homes. R-2000 can now be used as a step in the direction of healthier homes.

Environmental issues are also now a concern for many. Builders now have a set of guidelines to follow to show that their home can be more environmentally responsible. These guidelines can help make the house healthier for the occupants and even healthier for the builder who can reduce his/her exposure to contaminents by the use of the "cleaner" equipment and finishes. Harm to the environment comes not only from the type of materials, but also the amount of energy that the house consumes. The more efficient the house, the better it will be for the environment. In a nutshell, we can say that the R-2000 house is now becoming a "green" house.

Is there a cost to these changes? Generally, if better value os considered, there can be some incremental costs. A study done to review the impact of the proposed changes to the technical requirements found that the incremental cost (from current building practices of a production builder in the Ottawa area) would be about $5250 - 5500.

An important feature of this program, of course, is that there is a third party verification to the standards, so that the home buyer is provided with a measure of comfort that it's not just the builder telling them that the house is great. There actually is another group that provides a certificate to prove it!

This is how builders can take advantage of the program, and use it to market superior homes.

So is it a good idea? I think so.

The new R-2000 technical requirements are in force effective April 1, 1994.

Construction Alternatives: Insulated Building Forms

Lumber is a flexible, easy to use material, but with increasing demand, we're approaching the limit of available resources. High lumber prices are one way the shortage is being seen, which is why there is so much interest in alternative ways to build without wood.

Masonry and concrete have been used for a long time in many areas of the world, especially where they don't have wood (or where they've exhausted their local sources). In our cold climate, a major challenge for conventional masonry is providing adequate insulation. Several new building systems have been developed in the last few years that try to deal with this problem.

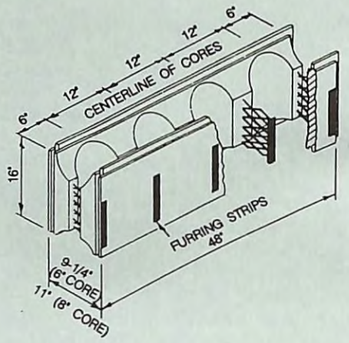
Polysteel Forms™ are a one step insulated building system that can be used for commercial and residential construction. Essentially it is a permanent insulated formwork that provides a cost effective and time saving method of building an insulated concrete wall.

The Polysteel Forms are light weight, made of expanded polystyrene and look like a giant foam block (16"x48" - 9.25" or 11" wide). The units are easy to use as they have interlocking tongues and grooves. Five galvanized steel strips on each side to enable the attachment of any type of interior or exterior wall finish using self-tapping screws.

During assembly reinforcing is placed as needed for structural and seismic considerations. All cores are filled with poured in place concrete. The result is a solid monolithic concrete wall with vertical columns spaced on 12-inch centres and horizontal beams on 16" centres, with webs of solid concrete in between. The insulating foam forms create good conditions for curing concrete, as the forms are never removed, so they result in stronger concrete.

One comment we've heard from builders using insulating form systems is that there are some restrictions on the rate you can pour concrete without creating bracing problems. Another consideration has to be the availability of concrete, and the insulation levels desired.

The manufacturer claims that the forms provide R22 insulating value, and that



the system has been thermographically tested with an average reading of R-28. The specific numbers should be tested rigorously so that we can have a fair comparison with other construction systems. This system is difficult to analyze on paper simply because of its irregular shape, which makes calculations tricky.

To get around the fact that they don't have a rigorously analyzed insulation profile, the distributors information package includes information about space heating energy consumption for a model home in Omaha, Nebraska, where separate meters on the space heating system were installed. The low energy consumption is impressive, but the information would be a bit more convincing if the monitoring had been done by a third party, and the if the information provided more data about the weather and indoor conditions.

However, the system does create a building envelope that is inherently airtight, so that heat losses caused by uncontrolled air infiltration are substantially reduced. As it is easier to control indoor air quality in an airtight home, better indoor air quality can be achieved with a properly designed and installed ventilation system.

For information about the 3.10 Polysteel Forms™ System:
Sound Structures & Supply Ltd.
Box 282, Christina Lake, B.C. V0H 1E0
Tel: 604-447-6459
Fax: 604-447-9499

Technical Research Committee News

Canadian Home Builders' Association

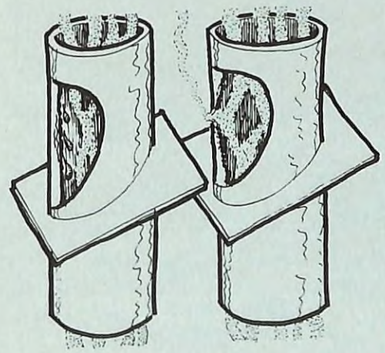
'A' Vent Failures

The use of A vents has been restricted in many jurisdictions,but many are still in service.

Several tragic incidents in Saskatoon this winter highlighted the importance of proper maintenance, and proper installation practices. The problem was amplified by the cold winter weather. A vents, which are a double walled, insulated flue, can corrode under appropriate conditions. As combustion by-products of natural gas appliances are largely water vapour, condensation will take place.

When the inner flue pipe corrodes, the condensation will work its way through the pits into the insulation. As we know, ice expands, so if there is enough moisture in the insulation, it will expand to the point that it chokes the flue, so you get a lump of ice blocking the flue.

In Saskatoon, the plugged flue meant that combustion gases had no where to go but inside. As it was cold outside, everyone had the house closed up tight so that toxic concentrations built up in the house.



The residents felt something was wrong - but it felt like all of them were coming down with the flu.

In fact, they were being poisoned. Unfortunately, 2 people died. In another incident in February - 3 were hospitalized - but recovered.

If you are using, or aware of A - vents, be sure that they are properly serviced and inspected regularly. Any indication of corrosion are and indication of potential troubles.

Moisture content in lumber

The building code for many years has required that framing lumber used in construction not have more than 19% moisture content (kiln dried is 10 - 12% in service lumber may have as little as 7 - 8%).

In Atlantic New Home Warranty program has announced they will be enforcing the 19% M.C. requirement in houses they cover. (It's not entirely clear how they plan to do the enforcing).

Carpet Staining

We've reported on the problems that many are experiencing, with carpet stains (especially pronounced with the light coloured carpets so fashionable today.

A research effort is being undertaken to offer a way to avoid such problems in the first place.

Any builders who've experienced such problems and are willing to participate in the research project (to provide samples, test solutions, etc) are invited to contact Ross Monsour at the TRC.
(Tel. 613-230-3060)

Airtightness Testing of market housing

In 1989 a cross Canada project tested a range of market houses for their airtightness. The results of this study were a significant factor in establishing ventilation requirements and code air sealing requirements.

It also has an impact on make up air requirements for large exhaust fans, combustion appliance air requirements and flue gas venting needs.

A new study is being undertaken to determine if houses are being built any different. If anyone has done or is aware of airtightness testing of market housing done in the last year and is willing to share results, is asked to contact Tom Hamlin at Natural Resources Canada at 613-947-1959

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector. Anyone with a problem, technical question of suggestions for areas that need to be investigated is encouraged to contact their local Home Builder's Association technical committee or the TRC directly. To contact the TRC:

Canadian Home Builders Association, Suite 200, 150 Kaurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060

EnviroHome: The CHBA-Canada Trust Environmental Homes Initiative

Initiatives such as the R-2000 home, the Advanced Houses Program and CMHC's Healthy Housing Design Competition have demonstrated Canadian expertise in building science as well as development of advanced building materials and technologies. While these efforts have led to significant improvements in the quality and performance of new housing in Canada, builders have always recognized the importance of commercial promotions as a means of stimulating consumer awareness for these improvements.

Consumer research has shown that home buyers find the idea of environmentally improved homes appealing but they often believe such homes lie in the future, rather than being commercially available today.

The Canadian Home Builders' Association and Canada Trust are sponsoring the EnviroHome, a commercial promotion of new housing incorporating a wide array of environmental features.

The EnviroHome is not a specific product, but a promotional event built around one, or more, "showcase" homes especially constructed for public tours and sales-lead generation.

EnviroHome events will have one central message - today's new homes, which offer improved environmental performance and a healthy indoor environment, provide real value for homebuyers.

The showcase homes are intended to serve as the centre-piece for local Home Builders' Associations wishing to promote the real value of today's new homes by highlighting the environmental and health features these homes provide.

Two pilot project locations have been selected for 1994: Edmonton (Lewis Nakatsui project manager) and Saint John, N.B. (Wayne Moore Contractor Inc). The purpose of these pilots is to develop experience and information about organizational, administrative and promotional aspects of this new initiative. It is anticipated that all CHBA local associations will be invited to mount an EnviroHome event in 1995.

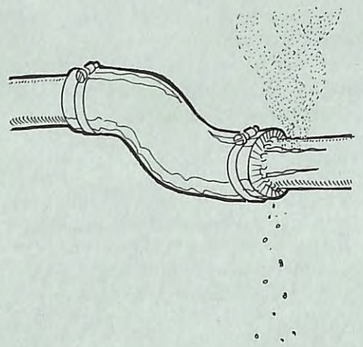
The technical requirements for an Envirohome are the new R-2000 technical standards, but all the environmental features on the pick list will have to be incorporated (the current standards call for a limited selection off the pick list).

Plastic Vents on Fuel Fired Appliances: *Caution!*

Ontario's Ministry of Consumer and Commercial Relations has issued a warning that some plastic gas venting systems on mid efficiency gas appliances may be failing at the joints or by cracking of the vent tube. If this happens, flue gases containing carbon monoxide could escape into the house. Carbon monoxide causes headaches, nausea, and, in extreme cases death.

The Ministry does not have detailed information about the cause or extent of the problem but there is enough evidence to justify issuing the warning notice. At this time, the only commitment from manufacturers is to repair deficiencies if they are a result of product failure.

The problem vents that have been identified are **Plexvent**[R], **Sel-vent**[R] or **Ultravent**[R]. Consumers with oil, natural gas and propane mid-efficiency furnaces, water heaters and boilers equipped with this type of plastic venting system are being advised to have this system checked



as soon as possible. Signs of leaky joints or cracks include water leakage or stains near the vent, stuffy or humid air and/or strange odours.

A protocol for inspecting systems has been developed. It calls for a visual inspection to check for pitch, support, clearance, etc. and a pull test to check for the integrity of the joints.

Builder liability is a concern, but it is evident that builders have satisfied all current legal requirements. There is no question that the systems are approved by standards agencies, the installation conforms to Building Code standards and the final inspection by utilities has been done.

Under the Ontario Energy Act, contractors installing an appliance are responsible to ensure that the venting system is properly installed. No contractor shall connect an appliance to a **Plexvent**[R], **Sel-vent**[R] or **Ultravent**[R] venting system, or any other venting system, unless they ensure that the venting system is approved, properly installed and provides adequate venting. For new installations, after April 18, 1994, only Plexvent[R], Selvent[R], or Ultravent[R] venting systems that have been installed by a person that has successfully completed a training program provided or accepted by the vent manufacturer will be approved in Ontario.

At this time, there is no clear alternative that will mitigate expenses. A single inspection cannot be relied on for the life of the system (manufacturers recommend an annual inspection). A stainless steel vent product is on the market for some furnaces but it is expensive and it may be susceptible to corrosion from acidic exhaust gases.

Two retrofits will clearly eliminate all risk. One is to replace the furnace (or appliance) with a high efficiency unit. The other is to replace the venting system with a vertical system with a vertical power vented "B-vent" or chimney thus requiring the ventilation system also be upgraded to an HRV.

Mid-efficiency appliances do not condense corrosive gasses before they are exhausted outdoors like high-efficiency models do. As a result, the corrosive gasses will condense and settle in the plastic venting pipes essentially rotting the silicone adhesives. This eventually leads to joint failure.

High efficiency gas units are not a problem, as their flue gas temperatures are lower, they use sealed vents, and they use PVC, ABS, or CPVC plastic vents.

For new homes, there are several options:

1. Install medium efficiency appliances with a masonry flue or B-vent.
2. Install a natural draft appliance with masonry flue or B-vent, although this is less efficient and will mean higher fuel bills for the home owner.
3. Install high efficiency appliances which are sealed combustion.

Manufacturer Hot-line Numbers for specific enquiries:

Plexvent	1-800-218-7132
	or (708) 350-3700
Ultravent	1-800-499-1609
Sel-vent	1-800-267-8178

Ontario builders should check with their local gas utility or the Ontario New Home Warranty Program for specific details.

Builders in other provinces: be warned!

Sustainable Development: One Company's Example

Worldwide pressures are pushing societies and economies to restructure. The prevailing attitude is one of bigger-is better with an emphasis on more things - more toys, gadgets, appliances, bigger vehicles, bigger houses, etc.

Unfortunately, consequences of materialism are too often environmental degradation, an erosion of human values and communities, and dying economies. There are indicators that we may be headed for an unprecedented social and economic crisis.

Present forestry practices are eating away not only nature's "interest" but also its "capital." In 1992 a Japanese White Paper on Forestry warned that all remaining forests will have been consumed in the next one hundred years. What is needed now is a total, comprehensive approach that oversees the whole range of the process from sustainable forest management to how wood is used in finished products.

If this sounds like the ramblings of an eco freak, think again. They are taken from a company brochure - a Japanese Building company that has become very successful too! Over 40 years, Kinoshiro Taisetsu Co. (KST) has built over 13,200 homes. They had a display at Globe '94 in Vancouver last March not to sell product - just their ideas.

The Japanese company was founded by a devout Buddhist who put into practice his philosophical world views. They are hoping to encourage a transition to a viewpoint of small-is-acceptable, with an emphasis on quality rather than quantity. Since the company was started 44 years ago, it has been striving for a healthy relationship between nature and man in local communities, contrary to popular trends.

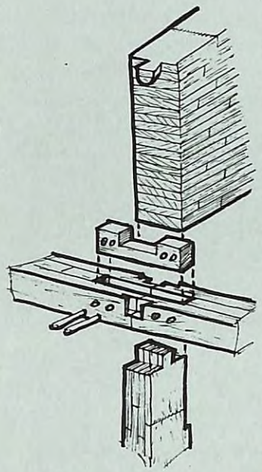
The application of modern technology for our convenience has separated us from nature. Household functions have been turned into marketable commodities. Communities are changing as young people move away and leave extended families behind. On an individual level, we've lost touch with our surroundings. If we can revitalize self-sufficiency in local communities, work will return to these places and family ties will become stronger.

They also want to reverse the current trend of society which encourages the separation of extended families by building homes capable of housing four generations. Such a home environment strengthens family ties, is conducive to thoughtfulness toward others, and has the potential to mend the torn fabric of society.

Many of KST's guiding thoughts are so fundamental they can be applied anywhere as long as they are tailored to the local context. It may be an example from which we can all learn.

KST is attempting to conserve the environment for future generations by putting into practice the dictum of "Reduce, Reuse, and Recycle". They draw on the wisdom that has been accumulated in traditional building techniques, recognizing it is not wise to forget them. They can be given modern expression by industrializing them. By this reuse they are using intangible gifts to produce tangible ones.

Old wooden buildings are designated as Japanese National Treasures. Some can last for 1,000 years. However, houses currently being built in Hokkaido last, on average, only 20 years because of poor design and building practices - a waste of timber resources. In the light of the global destruction of forests, KST has adapted carpentry techniques of Japanese master carpenters to build houses that will last for at least 100 years (100 years is the growth cycle for trees on Hokkaido). They have recognized that it is no longer rea-



sonable to build a house with expensive imported lumber from the rainforests of equatorial nations. The use of limited regional supplies of timber efficiently is indispensable to conserving their forests and to create a sustainable industry that will coexist harmoniously with nature.

The company has developed a bioregional design (systems and designs in harmony with the local environment) that incorporates an efficient and healthful heating system suited to Hokkaido's six month long, cold and snowy winters. The design promotes the health and longevity of the dwelling's inhabitants as well as the building itself.

They have addressed two of the major structural defects of the Hokkaido economy by utilizing labour resources during the winter and by integrating the division of labour. The housing they have developed has succeeded in generating work during the winter months, and has helped them to deal with problems of shortages of high quality lumber and skilled workers.

The vertically integrated manufacturing system means sub-groups share manufacturing overhead, building space, and administration to reduce costs and maintain quality control. KST's exploits indigenous materials and attempts to reduce dimensional timber use by taking advantage of lamination techniques that provide new uses for recycled wood and wood from thinned trees. They have industrialized many of the traditional carpentry skills to create sturdy, long lasting houses.

The traditional Japanese post-and-beam method has been modernized by KST. Elements of their house include:

- Five-pane, three-layer windows that have excellent insulation, air-tightness and noise proof qualities.
- A petchka (passive radiant Russian stove, also known as masonry stove) is used. It is capable of heating a space up to 10,800 sq. ft.
- Inverted roof designed to accommodate heavy snowfalls. The current design is the result of numerous trial and errors. (The Japanese, even in high snowfall areas, tend not to rely on pitched roofs on their urban buildings)
- Tongue and groove method that allows for wood shrinkage, helping to maintain function and beauty. (Components are made with and accuracy of 1/100 mm!)
- An airtight, insulated, wall.

KST has helped to fund the *International Ecodevelopment Institute* to further the communication of bioregional building ideas. For more information, or to contact the group:

International Ecodevelopment Institute
3-2, North 39, West 7, Kita-Ku
Sapporo, 011 Japan
Fax: +81-11-727-5987

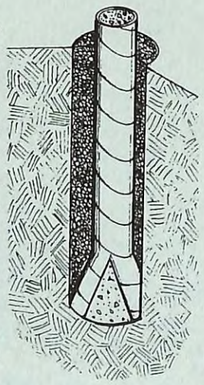
A Simplified Method of Constructing Concrete Pier Footings

Installation of concrete pier supports for small scale construction (e.g. decks, mobile homes) can be problematic and costly. If piers are installed, frost heave can cause destructive seasonal movement of the structure. If separate footings have to be poured to support the piers, greater time and cost are required to excavate and backfill especially if they have to go down 5 or 6 feet.

Ken Moase at Travellers Rest Mobile Homes Ltd., Kensington P.E.I. has suggested a simplified method of constructing footings. This idea was the winner of a job site Innovator Award sponsored by CMHC.

When digging holes for piers, use an auger at least 100 mm (4") larger in diameter than the cardboard forming tube being used. Before placing forming tubes, make four equally spaced saw cuts at the bottom of each tube extending 305 mm to 380 mm (12" to 15") up the wall tubes.

Install the tube in the ground, using pieces of wood to hold it in place. Pour in concrete until the base of the forming tube splays open and the concrete spreads out to form a 'footing'.



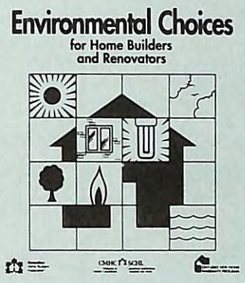
Where strip footings are not needed, this construction technique cuts costs by eliminating extra labour and excavation time.

This procedure takes little additional time and results in both a pier and effective footing from one concrete pour.

Footing sizes may have to be adjusted according to pier spacing. This innovation may be restricted to specific site and soil conditions. Check the applicable codes in your area.

Environmental Choices for Homebuilders and Renovators

If you're like most builders and renovators you know that the way that we operate our business has an impact on the environment. As a concerned builder, you know that it is important that we all take action to ensure a healthy environment for ourselves and our children. However, protecting the environment can mean changes in the way you do business.



There is no set formula for an "environmentally improved" home. Setting priorities and making effective choices takes careful thought. There are many ways to improve the homes you build or renovate to meet today's environmental, social and economic needs. The good news is that, in most cases, these changes make both technical and economic sense, and they can provide your customers with the quality they expect.

Environment Choices for Home Builder's and Renovator's Guide has been developed to help you understand the choices available to you and to present these choices with confidence to your customers. It explains how builders and renovators are uniquely positioned to make an environmental difference, and contains suggestions for marketing environmental benefits to your customers.

The guide is a 3 ring binder format, so that you can easily add extra pages as you find appropriate. Ten chapters (each under its own tab) cover basic products and technologies: windows, doors, space and water heating systems, water-conserving products, appliances, lighting, finishes, ventilation, home automation, building products and materials.

Products and technologies that offer environmental benefits are discussed, but if you are looking for specific products, this is not the source for you. For that, you will have to refer to any of several directories and guides such as new R-2000 Products Lists; Environmental by Design; Guide to Resource Efficient Building Elements. Publications and programs are listed at the back of the guide to provide you with sources of more information.

Terms are defined, types of products available are described along with their performance expectations, cost and installation issues are described, as is product availability. You can get a quick understanding of key concerns, what kind of questions to ask, and how to evaluate manufacturers' claims.

If you are trying to get a handle on what the environmentally responsible construction means, and to understand competing claims from suppliers' agents, then this handbook is for you.

Available for $ 34.00 (plus GST) From
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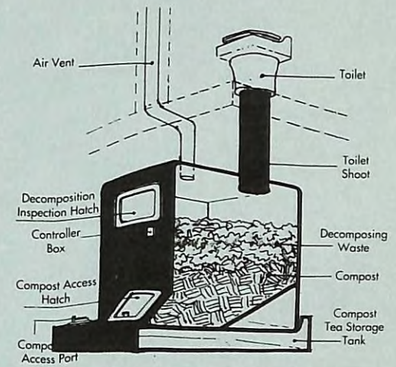
Composting Toilets



Composting toilets have been around for some time - the first self contained indoor composting toilet, the Clivus Multrum™, was developed in Sweden in the 1930's.

The unit, now made of 100% recyclable linear polyethylene plastic in Canada, has a sloping floor. Waste in the processor slides very slowly towards the compost removal chamber, decomposing naturally as it goes. The composting process processes solid and liquid toilet excreta through natural aerobic decomposition, reducing bio-mass input by around 95%, releasing carbon dioxide and water vapour. It produces odour-free, pathogen-free, safe-to-handle fertilizer end-products. On an annual basis, approximately 8 - 10 litres of compost will be generated per person. The Multrum™ is available in two sizes, with a variety of toilet options, including waterless, foam-flush, or half-litre flush.

The Clivus offers a pollution-preventing sanitation solution for locations where conventional sewage treatment is a problem, such as sites that have low percolation rates and high ground water conditions, sites with rock ledges, clay, sandy soils, difficult topographies, no water, permafrost, or inadequate lot size. It is

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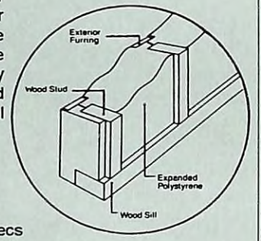

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specially suited for vacation and small residences. For slab-on-grade house or in areas where a septic tank/leach field is impractical, there are models that can be installed in a watertight concrete structure with maintenance access available through a bulkhead.

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For information:
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Tel 1-800-425-4887

Coming Soon: North America's first "Green" panel board: CanFibre MDF.

Solid wastes are a concern of worldwide as landfill sites are filled to capacity and new landfill development is being discouraged due to environmental concerns. In some areas the dumping of dry waste materials (including waste wood) have been outlawed altogether. Yet,

wood wastes represent a large portion of construction waste.

Declining forest inventories, a growing world population and the resulting increased demand for building and furniture products has created an expanding global need for engineered wood products. The industry is experiencing double digit growth rates, a trend expected to continue for the coming decade for products such as particleboard, oriented strand board (OSB) and medium density fibreboard (MDF).

MDF is experiencing the most rapid growth as it represents the highest quality product which can be moulded, routered and finished to a high quality without expensive laminating. However, conventional MDF panel producers face a problem, largely due to their reliance on Urea Formaldehyde (UF) resins for faster curing times in the manufacturing process. In the USA, the Environmental Protection Agency (EPA) has proposed measures which would vastly reduce the amount of UF allowed in the production of these products because they continue to emit harmful emissions long after manufacture. Alternative resins require considerably longer curing times which mean higher manufacturing costs.

A new Canadian technology developed by Forintek provides cost effective solutions for the production high quality wood panel products such as medium density fibreboard (MDF) from 100% recycled dry waste.

The process converts Industrial-Commercial-Institutional dry waste (wood, cardboard, cardboard drink containers containing metals and plastics and even non de-inked newsprint) to produce high quality manufactured-wood products including MDF. The technology allows the use of slower drying non-UF resins but still maintains production cost advantages.

The CanFibre Group Ltd. has acquired exclusive rights to the technology. They are finalizing agreements for the construction of MDF plants in Toronto and San Diego. Production is expected to begin by late 1995. Other Plant locations will be driven by retail demand for CanFibre based products rather than by wholesale demand for MDF.

The CanFibre "city plants" will be located very near to both the raw material supply (waste) and the market, so that freight savings are realized compared to conventional facilities located in remote forested areas. With the combined advantages of local production, considerable cost advantages in pressing technology, superior quality output and the lack of harmful UF gases, CanFibre expects to deliver their MDF at a cost up to 45% less than current manufacturers.

Information:
The Canfibre Group Ltd.
Suite 100 - 1500 West Georgia Street
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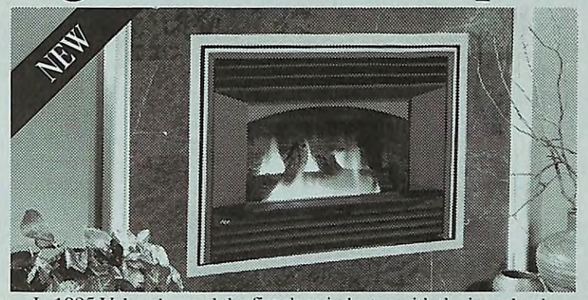
Introducing the New Legend Direct Vent Fireplace



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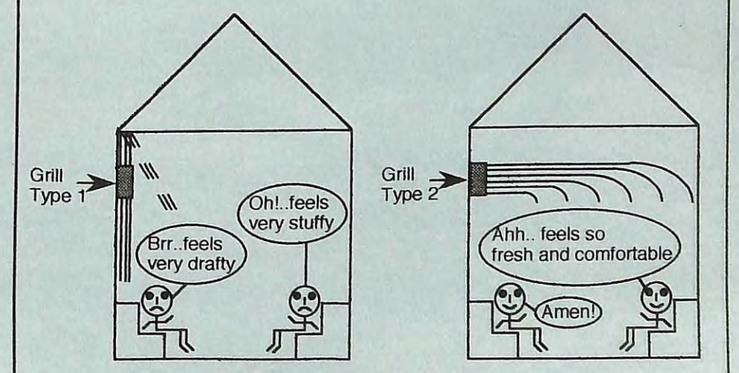

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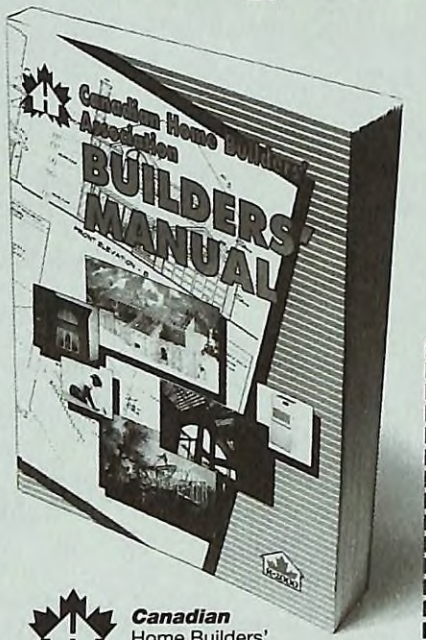

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